6-7 Roots and Zeros Homework
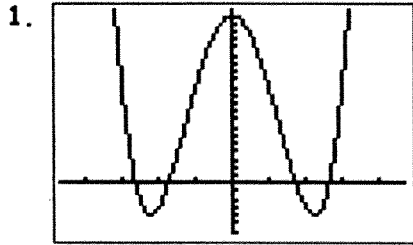
Name_____
Date_____ Block_____

Match each graph to its equation and describe the end behavior below the graph.

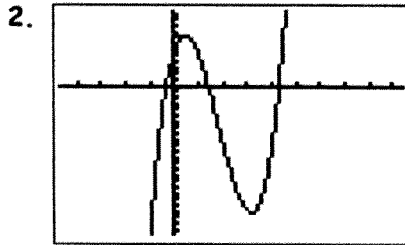| A. $f(x) = x^5 + 4x^4 - x^3 - 9x^2 + 3$	B. $f(x) = x^4 - 10x^2 + 21$	C. $f(x) = 3x^3 - 16x^2 + 12x + 6$

1.

Equation __B__

As $x \to -\infty$, $f(x) \to$ __∞__

As $x \to +\infty$, $f(x) \to$ __∞__

2.

Equation __C__

As $x \to -\infty$, $f(x) \to$ __$-\infty$__

As $x \to +\infty$, $f(x) \to$ __∞__

3.
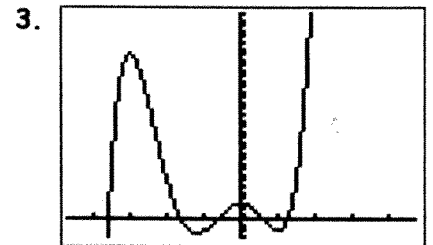
Equation __A__

As $x \to -\infty$, $f(x) \to$ __$-\infty$__

As $x \to +\infty$, $f(x) \to$ __∞__

Find ALL roots of each polynomial function over the set of complex numbers. CIRCLE YOUR ANSWERS.

4. $f(x) = x^3 - 8$

$$2 \,|\, 1 \quad 0 \quad 0 \quad -8$$
$$\quad 2 \quad 4 \quad 8$$
$$\overline{1 \quad 2 \quad 4 \quad 0}$$

$(x-2)(x^2 + 2x + 4)$

$\dfrac{-2 \pm \sqrt{4-4(4)}}{2}$

$\dfrac{-2 \pm \sqrt{-12}}{2}$

$\dfrac{-2 \pm 2i\sqrt{3}}{2}$

$\boxed{X = 2, \; -1 \pm i\sqrt{3}}$

5. $f(x) = 2x^3 + 4x - 6$

$$1 \,|\, 2 \quad 0 \quad 4 \quad -6$$
$$\quad 2 \quad 2 \quad 6$$
$$\overline{2 \quad 2 \quad 6 \quad 0}$$

$(x-1)(2x^2 + 2x + 6)$

$2(x-1)(x^2 + x + 3)$

$\dfrac{-1 \pm \sqrt{1-4(3)}}{2}$

$\dfrac{-1 \pm \sqrt{-11}}{2}$

or

$\dfrac{-2 \pm \sqrt{4-4(12)}}{4}$

$\dfrac{-2 \pm \sqrt{-44}}{4}$

$\dfrac{-2 \pm 2i\sqrt{11}}{4}$

$\boxed{X = 1, \; \dfrac{-1 \pm i\sqrt{11}}{2}}$

6. $f(x) = x^3 + 6x + 20$

$$-2 \,|\, 1 \quad 0 \quad 6 \quad 20$$
$$\;\; -2 \quad 4 \quad -20$$
$$\overline{1 \quad -2 \quad 10 \quad 0}$$

$(x+2)(x^2 - 2x + 10)$

$\dfrac{2 \pm \sqrt{4-4(10)}}{2}$

$\dfrac{2 \pm \sqrt{-36}}{2}$

$\dfrac{2 \pm 6i}{2}$

$\boxed{X = -2, \; 1 \pm 3i}$

7. $f(x) = x^4 - 6x^3 + 6x^2 + 24x - 40$

$$2 \,|\, 1 \quad -6 \quad 6 \quad 24 \quad -40$$
$$\quad 2 \quad -8 \quad -4 \quad 40$$
$$-2 \,|\, \overline{1 \quad -4 \quad -2 \quad 20 \quad 0}$$
$$\;\; -2 \quad 12 \quad -20$$
$$\overline{1 \quad -6 \quad 10 \quad 0}$$

$(x-2)(x+2)(x^2 - 6x + 10)$

$\dfrac{6 \pm \sqrt{36 - 4(10)}}{2}$

$\dfrac{6 \pm \sqrt{-4}}{2}$

$\dfrac{6 \pm 2i}{2}$

$\boxed{X = 2, -2, \; 3 \pm i}$

8. $f(x) = x^4 - 81$

$(x^2+9)(x^2-9)$

$(x^2+9)(x+3)(x-3)$

$x^2 = -9$

$x = \pm 3i$

$\boxed{x = \pm 3, \pm 3i}$

9. $f(x) = 16x^5 - 32x^4 - 81x + 162$

$16x^4(x-2) - 81(x-2)$

$(x-2)(16x^4 - 81)$

$(x-2)(4x^2+9)(4x^2-9)$

$(x-2)(4x^2+9)(2x+3)(2x-3)$

$4x^2 = -9$

$x^2 = -\dfrac{9}{4}$

$\boxed{x = 2, \pm\dfrac{3}{2}, \pm\dfrac{3}{2}i}$

10. $f(x) = 2x^4 + 7x^3 - 2x^2 - 19x - 12$

$$\begin{array}{r|rrrrr} -1 & 2 & 7 & -2 & -19 & -12 \\ & & -2 & -5 & 7 & 12 \\ \hline -3 & 2 & 5 & -7 & -12 \\ & & -6 & 3 & 12 \\ \hline & 2 & -1 & 4 & 0 \end{array}$$

$(x+1)(x+3)(2x^2-x-4)$

$\dfrac{1 \pm \sqrt{1-4(-8)}}{4}$

$\dfrac{1 \pm \sqrt{33}}{4}$

$\boxed{x = -1, -3, \dfrac{1 \pm \sqrt{33}}{4}}$

11. $f(x) = x^3 - 14x^2 + 68x - 120$

$$\begin{array}{r|rrrr} 6 & 1 & -14 & 68 & -120 \\ & & 6 & -48 & 120 \\ \hline & 1 & -8 & 20 \end{array}$$

$(x-6)(x^2-8x+20)$

$\dfrac{8 \pm \sqrt{64 - 4(20)}}{2}$

$\dfrac{8 \pm \sqrt{-16}}{2}$

$\dfrac{8 \pm 4i}{2}$

$\boxed{x = 6, 4 \pm 2i}$

12. $f(x) = x^3 + 27$

$(x+3)(x^2-3x+9)$

$\dfrac{3 \pm \sqrt{9-4(9)}}{2}$

$\dfrac{3 \pm \sqrt{-27}}{2}$

$\dfrac{3 \pm 3i\sqrt{3}}{2}$

$\boxed{x = -3, \dfrac{3 \pm 3i\sqrt{3}}{2}}$

13. $f(x) = 2x^3 + 5x^2 - 2x - 15$

$$\begin{array}{r|rrrr} 1.5 & 2 & 5 & -2 & -15 \\ & & 3 & 12 & 15 \\ \hline & 2 & 8 & 10 & 0 \end{array}$$

$(2x-3)(2x^2+8x+10)$

$2(2x-3)(x^2+4x+5)$

$\dfrac{-4 \pm \sqrt{16-4(5)}}{2}$

$\dfrac{-4 \pm \sqrt{-4}}{2}$

$\dfrac{-4 \pm 2i}{2}$

$\boxed{x = \dfrac{3}{2}, -2 \pm i}$